

Nutritional potential of *Solanum nigrum* linn berries grown in home garden

Lakshmi Jithendran, Chinnappan. A. Kalpana¹

Department of Home Science, Mount Carmel College, Bengaluru, Karnataka, ¹Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India

Abstract

Background: *Solanum nigrum* Linn is an annual herbaceous medicinal plant which can be cultivated in a natural setting. Normally this plant reaches a height of 35–100 cm. The flowers petals are greenish or whitish with bright yellow anthers. Black or purple color berries grown in bunches are noticed in this type of plants. Leaves, raw and ripe berries are consumed in different regions with a different culinary style.

Aim and Objective: The present study was aimed to analyze the nutrient content of the dried berries cultivated in a home garden.

Materials and Methods: Matured berries were harvested, shade dried and stored in air tight containers. Proximate principles, mineral, vitamin and phytochemical constituents of the dried berries were analyzed using standard procedures such as AOAC, inductively coupled plasma optical emission spectrometry, liquid chromatography-mass spectrometry and spectrophotometer methods.

Results: The study findings revealed that moisture (10.27%), ash (6.68%), fiber (1.4%), carbohydrate (40.4%), protein (3.86%) and fat (2.55%) were present in the sample. Energy content was found to be 186 kcal/100 g. Mineral analysis indicated that Ca (32 mg), Fe (0.56 mg), Al (0.42 mg), Cu (0.25 mg) and zinc were below detection limit per 100 g. Thiamine hydrochloride (0.37 mg), Riboflavin (0.24 mg), niacinamide (0.37 mg), pyridoxine (0.26 mg), folic acid bile-duct ligated, Vitamin C (5.42 mg) and beta carotene (7.52 mg) were present per 100 g of the dried berries. Phytochemical analysis revealed the presence of bioactive compounds such as alkaloids (3.3%), tannins (1.3%), saponins (2.9%).

Conclusion: The findings focus on the nutritional attributes of the herb which can be utilized in our household.

Keywords: Minerals, phytoconstituents, proximate analysis, *Solanum nigrum* linn, vitamins

Address for correspondence: Ms. Lakshmi Jithendran, Department of Home Science, Mount Carmel College, Bengaluru, Karnataka, India.

E-mail: lakshmi_jithendran@yahoo.com

Submitted: 04-Feb-2021 **Revised:** 05-May-2021 **Accepted:** 13-May-2021 **Published:** 06-Jul-2021

INTRODUCTION

India is a country gifted with traditional herbs and medicinal plants. Edible wild plants have been utilized by conventional societies to provide good nutrition and food security.^[1] *Solanum nigrum* Linn commonly known as black nightshade, usually grow in moist habitats

and can be cultivated in different climatic regions. It grows up to 90 cm high, with dull dark green leaves, juicy, ovate or lanceolate, and toothless to slightly toothed on the margins. Flowers are small and white with a short pedicellate and five widely spread petals. Fruits are seen as berries of small clusters. Green berries are turned to black or purple when it ripens. Leaves and berries of the plant are

Access this article online	
Quick Response Code:	Website: www.ijfans.org
	DOI: 10.4103/ijfans.ijfans_7_21

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Jithendran L, Kalpana CA. Nutritional potential of *Solanum nigrum* linn berries grown in home garden. Int J Food Nutr Sci 2021;10:16-9.

incorporated in different cuisines worldwide in the form of soups, gravies, accompaniments etc.^[2]

Infusions of the leaves, berries and stems are used to treat fever, dysentery and intestinal complaints.^[3] Anticarcinogenic and hepatoprotective property of the plant favor its wide usage in oriental medicine.^[4] The presence of secondary metabolites such as the total alkaloids, flavonoids, tannins, saponins, glycosides, proteins, carbohydrates, coumarins and phytosterol in *S. nigrum* Linn proved its antitumor activity.^[5] The crude extracts prepared from different parts of the plant including leaves, seeds and roots of *S. nigrum* Linn possess a potent antibacterial and antifungal activity.^[6] The ethanol extract of dried berries of *S. nigrum* was evaluated for anti-diarrheal activity.^[7]

Nutritive value of the leaves, seeds and raw berries of *S. nigrum* Linn was proved by a study conducted in Nigeria.^[8] According to the study results, dried berries showed a moderate amount of lipid and fair amount of carbohydrate, protein and fiber. The calorific value was also good for the dried berries. Mineral analysis of the berries showed high levels of magnesium and phosphorus but relatively low level of zinc. Vitamin content indicated the order Vit C > Vit B > Folic acid > Vit E > Vit A in and seeds. According to another study^[9,10] *S. nigrum* berries were analyzed for its antinutritional constituents such as tannins, trypsin and phytates which was found to be in moderate amounts.

Lot of research studies have proved the various medicinal principles of different parts of the plant. However, the knowledge of nutrition related information was not much available due to lack of attention because the species gain more medical focus rather than food aspect. Therefore the objective of the present study is to systematically characterize the nutritional value of the *S. nigrum* Linn berries cultivated in the home garden so that the usability of this plant could be advocated. It will help to bridge the gap of knowledge related to the nutritional aspects of the berries.

MATERIALS AND METHODS

Sample collection and preparation

S. nigrum plants were cultivated in the home garden of the investigator. The seeds were procured from an organic farm. Seeds were certified at Foundation for Revitalization of Local Health Traditions ENVIS center on medicinal plants, Bengaluru for authentication. Multiple harvesting was done for the berries when they turned purple in color and good yield was obtained.^[11] Berries were harvested and shade dried for 30–40 days. It was stored in airtight containers for further process.

Proximate analysis of the dried berries

Moisture, ash, protein and fat were determined by AOAC methods.^[12] Total carbohydrate was calculated by subtracting total ash content, crude fat, crude protein and crude fiber from the total dry matter. Dietary fiber content was analyzed by the enzymatic gravimetric method (AOAC 2000).^[13,14] Calorific value was analyzed by the percentages of crude protein, crude fat and total carbohydrate using the factors of 4, 9, 4, respectively.

Analysis of vitamins

Vitamin analysis was conducted to determine the B complex

vitamins such as thiamine, riboflavin, niacinamide, pyridoxine, folic acid and Vitamin C present in the dried berries using liquid chromatography-mass spectrometry (LC-MS/MS) method. It is a fast and sensitive method for quantitation of five of the B Vitamins simultaneously, using the 1290 infinity LC system coupled to a 6460 Triple Quadrupole LC/MS system in multiple reaction monitoring mode (Byrd *et al.*, 2010). Beta carotene content was analyzed using Ultraviolet spectrophotometer.^[15]

Analysis of minerals

Minerals such as iron, calcium, aluminum, copper, zinc, sodium and potassium were determined spectrophotometrically by inductively coupled plasma optical emission spectrometry (ICP-OES) method. ICP-OES is well established multi elemental analysis method and has been used in this study.^[16]

Analysis of phytonutrients

Berries were analyzed for the selected phytoconstituents. Total quantification of Alkaloids, Tannin and saponins was done using standard procedures.^[17]

RESULTS AND DISCUSSION

Proximate analysis of *Solanum nigrum* L., dried berries

Proximate analysis was conducted for the dried berries. Results are discussed in given Table 1.

Table 1: Proximate analysis of *Solanum nigrum* L Berries

Components	Values* (%)
Moisture (%)	10.27±0.07
Dietary fiber (%)	1.4±0.09
Ash (%)	6.68±0.39
Crude fat (%)	2.55±0.03
Crude protein (g)	3.86±0.15
Total carbohydrate (g)	40.4±0.77
Calorific value (kcal/100 g sample)	186±1.63

*Values are mean±SD of triplicate determinations. SD: Standard deviation

Table 2: Vitamin content of *Solanum nigrum* L berries

Vitamins	Values (mg/100 g)
Thiamine	0.37±0.04
Riboflavine	0.24±0.02
Niacinamide	0.37±0.05
Pyridoxine	0.26±0.02
Folic acid	BDL
Vitamin C	5.42±0.37
Beta-carotene	7.52±1.16

Values are mean±SD of triplicate determination. BDL: Below detection limit, SD: Standard deviation

Table 3: Mineral content of *Solanum nigrum* L Berries

Minerals	mg/100 g
Iron	0.56±0.03
Calcium	32.93±0.13
Aluminum	0.42±0.08
Copper	0.25±0.02
Sodium	2.00±0.16
Potassium	21.10±2.69
Zinc	BDL

Values are mean±SD of triplicate determination. BDL: Below detection limit, SD: Standard deviation

Hundred g of dried berries provided 10.3 percent moisture whereas ash was found to be 6.7 percent. Ash content of the seeds obtained in the present study compares favorable with a study of the same berry from Congo Brazzaville.^[18]

Amount of carbohydrate was found to be 40.8 percent whereas fat was 2.55 percent and protein was found to be 3.86 percent. Protein value is relatively higher compared to most berries (blueberry-0.74%, cranberry-0.4%, strawberry-0.8%) and even some of the tropical fruits such as banana-1%, orange-0.9%, apple-0.3%-0.4%.^[19,20] Calorific value of 100g of dried berries provided 186 kcal. Findings were in accordance with the study conducted^[8] on the same type of berries in Nigeria.

Vitamin analysis

Vitamin analysis for the dried berries was conducted using LC-MS/MS method. The results are formulated in the Table 2.

The amount of B complex vitamins were analyzed for the sample as it includes thiamine (Vitamin B1), riboflavin (Vitamin B2), niacin, Pyridoxine etc. The results are almost similar to a study conducted on *Solanum torvum* in Ghana (Akoto *et al.*, 2015). Folic acid estimation was found to be below detection limit among the vitamins estimated. Vitamin C, one of the immune strengthening vitamins was found to be 5.42 mg per 100 g of the sample. The result is comparatively good compared to the amount of Vitamin C in *Synsepalum dulcificum* berry; miracle fruit which has 1.33 mg per 100 g.^[21] Beta carotene was also quantified and the amount is appreciable compared to the same miracle fruit berry. The amount of beta carotene in *S. nigrum* berry was slightly lower than yellow colored vegetables.

Mineral analysis

ICP-OES technique was used to determine some of the mineral content of the berries. Results are depicted in Table 3.

As per the mineral amount analyzed from the above table, calcium was found to be most predominant among the minerals. Even though iron content was not that high compared to any other leafy vegetables, incorporation of the berries in to the recipe can contribute to the daily requirement. Zinc was found to be very low as it shows below detection level. Sodium and potassium were also present in appreciable amount as it plays an important physiological roles in our body. Presence of copper also supports the nutritive value of the berry as it helps to keep immune system and bones healthy. Elemental analysis results are in concordance with the study conducted on the nutraceutical importance of *S. nigrum* Linn.^[22,23]

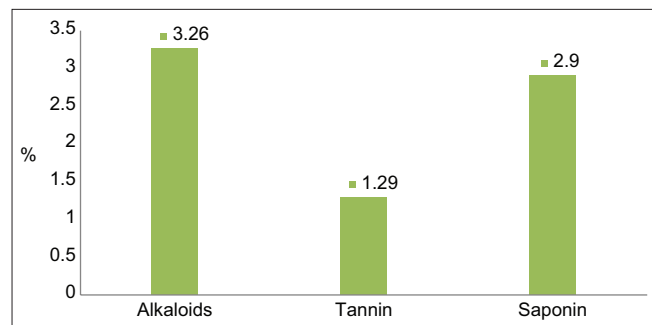


Figure 1: Phytochemical content of *Solanum nigrum* L Berries

Phytochemical analysis

Results of phytochemical evaluation are represented in Figure 1. The total amount of phytochemicals such as alkaloids, tannins and saponins are quantified. These constituents plays an important role related to health as they are known to exhibit medicinal as well as physiological activities (Sofowra A., 1993). Among the three phytochemicals analyzed in the dried berries, amount of tannin was found to be the least (1.29%). However there was not a major difference between the amount of alkaloids (3.26%) and saponins (2.90%) in the sample. Most of the phytochemicals act as natural antibiotics, which assist the body in fighting microbial invasion and infections.^[8]

CONCLUSION

Berries of *S. nigrum* holds good nutrient potential for most of the nutrients required for healthy growth and maintenance of the body. The dried berries can be incorporated in our dietary regimen to improve the overall nutrient content of the diets. Inclusion of berries in our meals increases the value addition with respect to its nutritional attributes. Presence of such plants in our kitchen or home garden ensures the availability of the berries for our consumption. Further research studies are necessary to explore the nutritional value of the berries subjected to various processing methods including different methods of cooking, fermentation etc., for its effective utilization in our culinary usage.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Antia BS, Akpan EJ, Okon PA, Umoren IU. Nutritive and anti. Nutritive evaluation of sweet potatoes (*Ipomoea batatas*) Leaves Pak J Nutr 2006;5:166-8.
2. Asibey-Berko E, Tayie FA. Proximate analysis of some under-utilized Ghanaian vegetables. Ghana J Sci 1999;39:91-6.
3. Jain SK. Medicinal Plants. Thomson Press Ltd., India, 1968: pp 133-4.
4. Gubarev MI, Enioutina EY, Taylor JL, Viscic DM, Daynes RA. Plant-derived glycoalkaloids protect mice against lethal infection with *Salmonella typhimurium*. Phytother Res 1998;12:79-88.
5. Husain A. Dictionary of Indian medicinal plants. Central Institute of Medicinal and aromatic Plants, Lucknow, Uttar Pradesh, India, Central Institute of Medicinal and aromatic Plants 1992:507-9.
6. Ikeda T, Tsumagari H, Nohara T. Steroidal oligoglycosides from *Solanum nigrum*. Chem Pharm Bull 2000;48:1062-4.
7. Bhatia N, Maiti PP. Evaluation of cardio protective activity of methanolic extract of *Solanum nigrum* Linn. in Rats. Int J Drug Dev Res 2000;3:139-47.
8. Akubugwo IE, Obasi AN, Ginika SC. Nutritional Potential of the Leaves and Seeds of Black Nightshade- *Solanum nigrum* L. Var virginicum from Afikpo-Nigeria. Pak J Nutr 2007;6:323-6.
9. Jain R, Sharma A, Gupta S, Sarethy IP, Gabrani R. *Solanum nigrum*. Current perspectives on therapeutic properties. Altern Med Rev 2011;16:78-85.
10. Sarma H, Sarma A. *Solanum nigrum* L., A nutraceutical enriched herb or invasive weed? In: International Conference on Environment and Bioscience IPCBEE. Vol. 21. IACSIT Press, Singapore; 2011. p. 105-9.

11. Jithendran L, Kalpana CA. Food and Nutrition Research to Transform the Future “Edited book of 33rd Biennial Conference of HSAI – Trends for Futuristic Development in Home Science: Research and Innovation. Shanga Verlag Publishers, 174, Nethaji Road, Pappanaicekenpalayam, Coimbatore, Tamilnadu; 2019. p. 102-7.
12. AOAC. Official Methods of Analysis of the AOAC. 18th ed. Washington, DC: AOAC; 2000.
13. McCleary B. V. Dietary fibre analysis. The Proceedings of the Nutrition Society, 2003;62:3-9. <https://doi.org/10.1079/PNS2002204>.
14. Osborne DR, Voogt P. Calculation of caloric value. In: Analysis of Nutrients in Foods. New York: Academic Press; 1978. p. 23-34.
15. Karnjanawipagul P, Nittayanuntawech W, Rojsanga P, Suntornsuk L. Analysis of β -carotene in carrot by spectrophotometry. J Pharm Sci 2010;37:8-16.
16. Kumaravel S, Alagusundaram K. Determination of Mineral Content in Indian Spices by ICP-OES. Orient J Chem 2014;30.
17. Ezeonu CS, Ejikeme CM. Qualitative and qualitative determination of phytochemical contents of indigenous Nigerian softwoods. N J Sci 2016;2016:9.
18. Dhellot JR, Matouba E, Maloumbi MG, Nzikou JM, Dzondo MG, Linder M, *et al.* Extraction and nutritional properties of *Solanum nigrum* L. seed oil. Afr J Biotechnol 2006;5:987-91.
19. Ihekoronye AI, Ngoddy PO. Integrated Food Science and Technology for the Tropics. London: Macmillan Publishers Ltd; 1985. p. 65-193, 283-294.
20. Nwofia GE, Ojmelukwe P, Eji C. Chemical composition of leaves, fruit pulp and seeds in some Caricapapya (L) morphotypes. Int J Med Aromatic Plants 2012;2:200-6.
21. Njoku NE, Ubbaeonu CN, Alagbaoso SO, Eluchie CN, Umelo MC. Amino acid profile and oxidizable vitamin content of *Synsepalum dulcificum* berry (miracle fruit) pulp. Food Sci Nutr 2015;3:252-6.
22. Byrd N, C. Bri, C. Campden, 2012. Rapid, sensitive and cost effective detection of B vitamins in foods by HPLC/MS/MS. Agilent Technology Inc. Available at <https://www.agilent.com/cs/library/applications/5991-0647EN.pdf>. [Last accessed on 2021 May 03].
23. Sodipo OA, Akiniyi JA, Ogunbano US. Studies on certain characteristics of extracts of bark of *Pausinystalia jobimbe* and *Pausinystalia macroceras* (K. Schum.) Pierre ex Beille. Glob J Pure Appl Sci 2000;6:83-7.